

REPLY
(Translation)

To : Examiner of the Patent Office, TAKAGI Masahiro

1 Identification of the International Application

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5 Subject matter of Reply

(1) As to the content of Written Opinion

In Written Opinion dated July 5, 2005, there is written an opinion out that the inventions in accordance with Claims 1 to 10 of the instant application do not have inventive step.

In response to such opinion, claims 1 and 10 are amended by AMENDMENT submitted on the same day as this Reply. Based on such amendment, we are sure that the invention of Claims 1 to 10 have inventive step. The explanation follows.

(2) Explanation of the Present Invention

The present invention relates to the following:

"A lead storage battery including:

an electrode plate pack comprising a plurality of negative electrode plates which each comprise a negative electrode grid having a tab and a negative electrode active material layer retained by said negative electrode grid, a plurality of positive electrode plates which each comprise a positive electrode grid having a tab and a positive electrode active material layer retained by said positive electrode grid, and a plurality of separators separating said positive electrode plate and said negative electrode plate;

a positive electrode connecting member comprising a positive electrode strap to which said tab of each positive electrode plate of the electrode plate pack is connected, and a positive electrode pole or a positive electrode connecting body provided at said positive electrode strap;

a negative electrode connecting member comprising a negative electrode strap to which said tab of each negative electrode plate of the electrode plate pack is connected, and a negative electrode pole or a negative electrode connecting body provided at said negative electrode strap;

wherein said positive electrode grid, said negative electrode grid, said positive electrode connecting member,

and said negative electrode connecting member comprise a Pb-alloy including at least one of Ca and Sn;

said negative electrode active material layer includes Sb;

said separator includes silica; and

said electrode plate pack, said positive electrode strap, and said negative electrode strap are immersed in an electrolyte" (Claim 1); and

"The lead storage battery including:

an electrode plate pack comprising a plurality of negative electrode plates which each comprise a negative electrode grid having a tab and a negative electrode active material layer retained by said negative electrode grid, a plurality of positive electrode plates which each comprise a positive electrode grid having a tab and a positive electrode active material layer retained by said positive electrode grid, and a plurality of separators separating said positive electrode plate and said negative electrode plate;

a positive electrode connecting member comprising a positive electrode strap to which said tab of each positive electrode plate of the electrode plate pack is connected, and a positive electrode pole or a positive electrode connecting body provided at said positive electrode strap;

a negative electrode connecting member comprising a negative electrode strap to which said tab of each negative electrode plate of the electrode plate pack is connected, and a negative electrode pole or a negative electrode connecting body provided at said negative electrode strap;

wherein said positive electrode grid, said negative electrode grid, said positive electrode connecting member, and said negative electrode connecting member comprise a Pb-alloy including at least one of Ca and Sn;

said negative electrode active material layer includes Sb;

said separator includes silica;
the mass ratio of the negative electrode active material to the positive electrode active material in said electrode plate pack is 0.7 to 1.3; and
said electrode plate pack, said positive electrode strap, and said negative electrode strap are immersed in an electrolyte" (Claim 10).

(3) Explanation of the Amendment

Based on paragraph number [0042], lines 1 to 3 of the description of the present invention, it is clarified in Claims 1 and 10 that the electrode plate pack, the positive electrode strap, and the negative electrode strap are immersed in the electrolyte.

(4) Inventive Step of the Present Invention

The present invention relates to a lead storage battery including:

an electrode plate pack comprising a plurality of negative electrode plates which each comprise a negative electrode grid having a tab and a negative electrode active material layer retained by said negative electrode grid, a plurality of positive electrode plates which each comprise a positive electrode grid having a tab and a positive electrode active material layer retained by said positive electrode grid, and a plurality of separators separating said positive electrode plate and said negative electrode plate;

a positive electrode connecting member comprising a positive electrode strap to which said tab of each positive electrode plate of the electrode plate pack is connected, and a positive electrode pole or a positive electrode connecting body provided at said positive electrode strap;

a negative electrode connecting member comprising a negative electrode strap to which said tab of each negative

electrode plate of the electrode plate pack is connected, and a negative electrode pole or a negative electrode connecting body provided at said negative electrode strap.

The invention is characterized in that the positive electrode grid, the negative electrode grid, the positive electrode connecting member, and the negative electrode connecting member comprise a Pb-alloy including at least one of Ca and Sn;

the negative electrode active material layer includes Sb;

the separator includes silica; and

the electrode plate pack, the positive electrode strap, and the negative electrode strap are immersed in an electrolyte.

Thus, chargeability is improved and corrosion of the negative electrode grid tab is reduced, making it possible to provide a lead storage battery with a long service life under a usage mode of repeating charge and discharge frequently under a relatively low SOC (state of charge) range.

On the other hand, Patent Document 1 (JP 2847761 B2) discloses a sealed lead storage battery including a separator comprising silica powder and glass fiber. The document also discloses the ratio of the negative electrode active material amount to the positive electrode active material amount of about 1.1.

Patent Document 2 (JP 2003-346888 A) discloses that the negative electrode active material layer or the frame of the negative electrode grid includes Sb.

In Written Opinion, it is pointed out that those skilled in the art easily arrive at the idea of including known Sb in the negative electrode active material layer of the lead storage battery of Document 1 including the separator containing silica.

However, when Sb is included in the negative electrode

active material layer of the sealed lead storage battery of Patent Document 1, a gas generated by Sb easily makes the control valve to be in an opened state, thereby letting the air flows into the battery. Additionally, in the sealed battery of Patent Document 1, the amount of electrolyte is generally small (for example, (二) of Claim 1, in Patent Document 1), and a portion of the negative electrode plate and the negative electrode strap are exposed in the air. Therefore, even Sb is included in the negative electrode active material layer of the sealed lead storage battery of Patent Document 1, the structure of the present invention cannot be obtained. Moreover, because the negative electrode plate and negative electrode strap make contact with oxygen in the air, the negative electrode plate (especially the tab of negative electrode plate) and the negative electrode strap are oxidized, to advance the deterioration of the battery. Therefore, the effects of the present invention as noted in the above cannot be obtained at all.

In the present invention, on the other hand, since the electrode plate pack, the positive electrode strap, and the negative electrode strap are immersed in the electrolyte and are not exposed to the air, batteries do not deteriorate from the oxidization due to the contacts between oxygen in the air and the negative electrode plate and the negative electrode strap.

Additionally, Documents 1 and 2 do not describe or imply the effects of the present invention, i.e., a long service life is enabled under a usage mode in which charge and discharge are repeated frequently under a low SOC range.

Therefore, even a person skilled in the art cannot easily arrive at the invention of Claim 1 of the present invention, based on Documents 1 and 2 having no description of the structure and effects of the present invention.

From the above, the invention of Claim 1 of the instant

application has inventive step.

Claim 10 of the present invention includes Claim 1 of the present invention. Since the invention of Claim 1 has inventive step, similarly, Claim 10 of the present invention also has inventive step.

Claims 2 to 9 of the present invention refer to the recitation of Claim 1. Since Claim 1 of the present invention has inventive step, as described in the above, Claims 2 to 9 of the present invention also have inventive step.

(5) Conclusion

For the above reasons, we believe that the inventions described in Claims 1 to 10 of the instant application have inventive step.

Therefore, we would like to request an affirmative International Preliminary Examination Report to be prepared with respect to the novelty, the inventiveness, and the industrial applicability of the present invention.